MESUR PATHFINDER MICROROVER FLIGHT EXPERIMENT - A PARADIGM F-OR VERY LOW-COST SPACECRAFT

Donna Shirley Pivirotto
MESUR Pathfinder Microrover Team Leader
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, Ca 91109 USA

The MESUR Pathfinder Microrover Flight [experiment (MFEX) will be carried by the Mars Environmental Survey (MESUR) Pathfinder mission to the surface of Mars, where it will perform technology, science and MESUR mission engineering experiments in July 1997. The total cost of MFEX, including H/M/ and S/W development, mission design, operations and inflation is $25M, but it will perform many of the functions of large rovers estimated to cost over $1 B.

The MFEX rover incorporates the basic functionality of any spacecraft: it is self contained (solar powered); it takes pictures; carries and supports an instrument; performs experiments; is commanded; collects, stores, packetizes and downlinks data; monitors and controls its attitude; actively manages its power and its thermal control; and telecommunicates. In addition it functions on the Martian surface, a much harsher environment than most spacecraft must face. On top of that, the microrover must interact with and respond to its environment in an "intelligent" fashion rather than merely exercising preprogrammed sequences as an ordinary spacecraft does.

In order to pack such performance into a $25M cost cap, a mix of new and old technology has been employed. The autonomous control system, mobility system, and thermal control system have all been invented for MFEX, building on the NASA telerobotics and rover technology programs, On the other hand, MFEX makes extensive use of commercial components, and has created new processes for qualifying them for space application. Finally, new approaches to cost estimation, risk management, and program control have all been used to ensure that the cost cap is not exceeded. The lessons learned from MFEX are applicable to a whole class of low-cost space missions.